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Plant Pathologist, Virginia Agricultural Experiment Station



REPRINT FROM THE REPORT OF THE TWENTY-THIRD ANNUAL
SESSION OF THE VIRGINIA STATE HORTICULTURAL SOCIETY,
HELD AT LYNCHBURG, VA., DECEMBER 3, 4, 5, 1918.



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CEDAR RUST ¹

F. D. FROMME

The man who knows cedar rust would not consider Cedarville a desirable location for an orchard. He would not be attracted to Cedar View by the view, and would scarcely take a planting of Yorks at Cedar Grove as a gift unless he knew that the grove had been axed. There are ten more towns in Virginia with equally suggestive names. The list runs from Cedar Bluff, Cedarecliff and Cedar Creek to Cedar Springs, Cedar View and Cedarville. But this does not exhaust the possibilities. We have enough red cedars in the State to supply names for all of the post offices in the United States.

The red cedar, *Juniperus virginianae*, is a native of the American continent, and, as the name indicates, it feels right at home in Virginia. In 1825, almost a century ago, Schweinitz discovered the cedar rust fungus on cedar trees in North Carolina. It had been there waiting for a Columbus for centuries. Several years later the same botanist found the other stage of cedar rust on the wild American crab-apple. He did not suspect the relationship that exists between the two and a half-century passed before this proof was given. Previous to this, in 1865, a Dane named Oersted had proven the connection between another species of cedar rust in Europe on the European red cedar and the pear, but there were doubting Thomases in his day as there are in ours. I am going into history to point out that cedar rust is as old as the hills, and that the fact that cedar rust on apple comes from cedar rust on cedar has been known for thirty years.

Our cedar rust is not the only member of his family; he has some thirty brothers who live on different species of cedars during the fall and winter and on members of the apple family,

¹ An address delivered at the meeting of the Virginia State Horticultural Society, December, 1918.

especially wild-crabs, hawthorns and shad bushes, during the spring and summer. This seems an odd sort of a life, but it answers the needs of cedar rust in the same way that our needs are answered by vegetables in the summer and pork and beans in the winter.

Previous to the establishment of the orchard industry on a commercial scale cedar rust was having a hard time. It was limited by the distribution of wild crabs and the occasional home apple tree. It came into its own, however, with the extensive planting of apples, particularly of the York Imperial and Ben Davis. The farmer, with true Virginia hospitality, did all he could to make cedar rust comfortable. He supplied apple leaves and fruit for its food in summer; he planted cedars on his lawn and allowed them to grow along fences and roads and rock breaks to keep it from starving in the winter. Cedar rust thrived and waxed fat and multiplied. He had found his place in the sun.

Before long, cedar rust was taking more than its share of apples. The farmer wasn't getting many, and those that he got weren't worth much. He thought the apples were running out; they were costing him more than they were bringing in. Cedar rust had completed its metamorphosis from a poor, struggling, scientific curiosity to a pest of the first magnitude.

The farmer finally told his troubles to the Experiment Station, and the answer came: "Cut down the red cedars and the trouble will disappear." The farmer scoffed, but the germ of the idea stuck. After another season or two of losses he tried it out surreptitiously on a few cedars near the orchard. To his surprise and amazement the thing actually worked. He used the axe on all of the cedars on his own place and persuaded his neighbors to do the same—and cedar rust starved to death.

To get back to some facts and figures, cedar rust has been robbing the fruit growers of Virginia of about one-half million dollars worth of apples every year or so for the past eight or ten years. Letters of inquiry began to come to the Experiment Station in 1901 and 1902. In a letter of August 19, 1902, to

Mr. E. J. Turner of Galt's Mills, Professor Alwood wrote: "The leaves show what is commonly called orange rust of the apple. This disease is caused by a fungous growth which very commonly attacks apple leaves *and of late years is becoming a serious pest.*" (The italics are mine.)

The development of this disease as a destructive agent parallels the development of the orchard industry. Its phenomenal increase was made possible by the extensive planting of two susceptible varieties, York Imperial and Ben Davis, especially the former. It is restricted, as may be seen on the map (shown herewith), very largely by the planting of these two varieties.

The effect of cedar rust on the York is quite different from that on Ben Davis. The attack is chiefly on the foliage which falls early, leaving half-nourished, undersized apples. When the infection is heavy the losses are almost complete. Promising number ones are reduced to culls, the loss varying with the season and the difference between the selling prices of barreled apples and cider stock. This year it amounted to about \$2.50 per barrel. This is not, however, the sum total of the damage cedar rust does on the York. The tree itself suffers severely. Growth is arrested, few fruit buds are formed, and the next year's crop is sure to be a light one. A heavy cedar rust infection thus means a loss of a large part of two years' crops.

The loss on Ben Davis is not so complete, but it is still a very important one. The foliage is not seriously injured but much of the fruit is spotted, the result being that, on the average, about two barrels out of three are packed as Number 2 instead of Number 1. Shenandoah County growers lost heavily on Bens in 1917. Number 2 sold at \$2.00 and Number 1 at \$3.50. The grower lost \$1.50 per barrel.

I will not tire you with records of losses. Many of you know of these from personal experience. I have statements from four orchards in Shenandoah County whose combined losses in 1917 were \$12,150.00, or an average loss per orchard of \$3,050.00. The loss for the county was estimated at \$100,000.00. Augusta County lost heavily on Yorks this year, fifty

per cent of the crop going as culls according to the information given me. I have heard that in parts of Rockingham this year only 15 or 20 per cent of the Yorks were fit to barrel.

Following the epidemics of 1910 and 1912 some of the fruit growers, who saw the serious menace of the cedar to the life of the orchard industry, went to the Legislature and secured the Cedar Rust Law. The law became effective with its passage on March 4, 1914, subject to its local adoption. It declares the red cedar tree a nuisance and provides for its destruction. I presume that no explanation of the law is necessary here. Copies of it may be had on application to the State Entomologist at Blacksburg.

The law has been in operation for four years in Frederick County, and for shorter periods in other counties. It has to date been adopted for all of Frederick and Botetourt counties, for three districts in Clarke and three in Shenandoah, two in Rockingham and two in Augusta. This involves the greater part of the territory which has been subject to heavy cedar rust losses.

There can be no question but that the law has been, and is capable of being, of great benefit to the fruit grower. The mere fact of the existence of the law has been sufficient in many cases to overcome the objections of owners of cedar infested land, and according to the figures of the State Entomologist less than half of the 90 cases which have been taken up under it have gone to the stage of court proceedings. Although there has been some criticism of the law by the fruit growers, it is unquestionably workable, and you can get results from it.

I do not assume that there is any necessity for a defense of the law and would not attempt one if there were. I believe that every one concerned would welcome a better law if a better one could be obtained.

It should not be necessary to resort to the law except in rare cases. It should be possible to convince any reasonable man that his cedars are doing you a real damage. He would not expect you to keep a sheep-killing dog in immunity, nor allow

black leg in your cattle to endanger his. Point out that the removal of cedars along fence rows and in pastures will improve his land. Tell him that the large cedars on his lawn will bring a good price as lumber for cedar chests, or that landscape gardeners have condemned them as unaesthetical if that will convince him. Then, if he cannot be reached except through the law, use it on him, but try "moral suasion" first.

I believe the failure to obtain the maximum benefits of cedar eradication can be put squarely up to the fruit grower himself. He has procrastinated and vacillated between the seasons of light and heavy cedar rust. During harvest, when the results of cedar rust are so apparent, it is easy enough to cut down the cedars in your mind. But the resolve easily fades with time. The winter months slip by with their demands for pruning and spraying, and spring finds the resolution pigeon-holed in the hope that maybe there won't be much cedar rust this year anyhow.

I have the greatest sympathy for the isolated fruit grower who cannot hope to secure the adoption of the law and who cannot reach his neighbors' cedars through argument or appeal, but I feel that when fruit growers in a fruit county allow cedar rust to continue its destruction they have themselves to blame.

What have been the benefits of cedar eradication and what have been the costs?

Any one who went along on the fruit growers trip this summer could not have failed to note the difference in the appearance of the York foliage in Augusta, Rockingham and Shenandoah counties and that in Frederick and Berkeley. There was all the difference between day and night. In the first three cedar rust came out and hit you in the eye, and in the last two you had to look for it. Frederick and Berkeley have cut cedars on an extensive scale. Berkeley seemed to be more free from cedar rust than Frederick. We saw acres on acres of Yorks and Bens there and cedar rust was conspicuous by its absence. It seemed to be the least of their worries. Berkeley County was a hot-bed of cedar rust a few years ago.

You could find some cedar rust in Frederick, but I would rather have had pennies for all of the spotted leaves I could have found in the average orchard in Augusta than dollars for those in Frederick.

There are still cedars in Frederick County and consequently still some cedar rust, but many of the worst cedars have been removed and a great measure of relief has been obtained. I will not dwell on the situation. There are men here from that county who know the situation there better than I and who could give a better statement of it.

One of the mistakes often made in cedar eradication is lack of thoroughness. I once visited an orchard with a bad case of cedar rust where the owner assured me that he had cut all of the cedars within a mile. I found two thirty-foot cedars within a quarter of a mile in a favorable location and in the direction of the prevailing winds. He had cut some fifty cedars and had left enough to negative most of the good he had accomplished.

When we remember that each cedar gall is capable of producing about seven billion spores, and that a cedar tree may easily bear a thousand of these galls, we realize the necessity of removing every single cedar.

The width of the cedar free zone necessary for protection will naturally vary with conditions, and no fixed rule can be applied to all cases. As a general rule the mile limit specified by law is sufficient, but in regions of high cedar-bearing ridges with unbroken sweeps of wind, we can naturally expect the spores to be carried greater distances. The question of how far cedar rust spores can be carried simply resolves itself into a problem in physics. The wind velocity, the weight of the spore, and the height at which it is discharged determine the distance it can be carried. It is certainly possible from a mathematical standpoint for some spores to be carried a distance of ten miles in a high wind. But the survivors at this distance will be few, and they will scatter over such a wide area that the infection on apple will amount to almost nothing. A very large percentage will fall within the first mile.

We made some observations in an orchard in Clarke County which show how rapidly the degree of infection decreases as the distance from the cedars increases. There were by count an average of 200 spots per twig at 100 yards from the cedars, 70 spots per twig at 200 yards, and only 16 at 500 yards. Ninety-five per cent of the spores had fallen within 500 yards. This, of course, indicated a wind of low velocity but it illustrates the principle. The scattering of a charge of buckshot increases with the distance from the muzzle of the gun, and a charge of cedar rust spores behaves in the same way.

I would not answer the question, "Is the mile limit enough?" with a yes or no. It will depend on conditions. It will give ample protection, I believe, in more than 95 per cent of the cases. If necessary, go back more than a mile. It is a question, in any case, of weighing the cost of cedar eradication against the benefits to be derived, and that brings up the question which is perhaps, in your minds, the most important one of all.

Is the cost prohibitive; is it considerable but still not out of the question, or is it a matter of little moment? In an occasional and very rare case it may be prohibitive. In a small percentage of cases it may fall in the second class, but in the vast majority of cases it will fall in the third; the cost will be almost negligible.

Cedar eradication is the cheapest form of orchard insurance you can buy. The cost on the average is less than the cost of a single spray application.

I have two sets of figures which present the matter from different angles. One shows the cost per acre of clearing up cedar-infested land, and the other shows the cost of cedar rust protection for an acre of apple trees.

In Berkeley County, West Virginia, during 1912 and 1913, there were 1,114 acres of land cleared of cedars at a cost of \$532.00, or at the average cost per acre of less than fifty cents. This acreage was made up of the average proportion of pasture, fence row, rock break and cedar ridge. The average rate of pay was \$1.75 per day. A clearing of about 200 acres was ruled it would still be negligible as compared to the losses sus-

necessary for the protection of the average orchard, and the average cost per orchard on this basis about \$100.00. Taking 40 acres as the average orchard unit the cost per acre of apples would be \$2.50.

Perhaps you think these figures too low. Let us see how well the figures from Frederick County support them.

The published statement of the State Entomologist shows an expenditure for Frederick County of \$2,313.92 for cedar eradication during 1915, 1916 and 1917. The total including 1918, so he informs me, will not exceed \$3,000.00. The orchard acreage of Frederick County, according to the best available figures, is about 12,000 acres. If this sum is prorated according to acreage it will mean a cost to the fruit growers of only twenty-five cents per acre. But this involves only the cost of cutting cedars under the law and does not include the extra-legal cutting, which, at a guess, amounted to ten times as much as the legal cutting. This would raise the figures to \$2.50 per acre. A margin of safety is provided here in the fact that legal cutting costs more than extra-legal cutting. About one-third of the expense of legal cutting is occasioned by damages and court proceedings.

It is an interesting fact that the same cost figure, \$2.50 per acre, was reached by independent figuring from two different standpoints. I believe it is pretty close to the mark. If you still think the figure low, consider the increased value of the land and the sale of the cedar wood and lumber.

How does this cost of \$2.50 per acre for cedar rust protection compare with the tax the fruit grower pays for protection from other orchard diseases and pests?

According to Mr. C. F. Massey's figures in the last report of the Society, the cost of a single spray application in Frederick County in 1917 was \$3.08 per acre. His figures are \$221.90 for three applications on 24 acres. The growers of Frederick County, if my figures are reasonably accurate, have had four years protection from cedar rust at the cost of a single spray application. Even though the cost of cutting cedars were quad-

tained from cedar rust and would be no more than the annual addition of one spray to the present schedule.

The question is often asked, "Is there no spray for cedar rust?" Why in the world should any one want to spray for cedar rust? It is cheaper to cut down the cedars. If I were to tell the fruit grower that he could add one spray to his schedule and control cedar rust (I do not anticipate ever making such a statement) I believe he would consider it a fine solution of the problem. The statement I will make him is this: Use the money that an additional spray would cost you on cedar eradication. You will be rid of the menace in a year or two.

Suppose we take these figures and apply them to another large York-producing county, Augusta. The cedar rust toll there was about \$150,000.00 this year. These figures are based on data supplied me by Mr. W. A. McComb. Augusta County shipped 330 cars or 66,000 barrels of culls to cider and vinegar plants. Ninety per cent of these culls were caused by cedar rust. The loss on 59,400 barrels at \$2.50 per barrel amounts to \$148,500.00. If this loss were prorated among the estimated 8,500 acres of apple trees in the county it would amount to \$17.60 per acre, or seven times the cost of cedar eradication.

Augusta County is only an illustration. The argument will apply with equal force in Shenandoah, Rockingham, Clarke and Botetourt. In all of these counties from 40 to 50 per cent of the trees are York and Ben Davis.

I have touched only the most important phases of the cedar rust problem as I see it. I have admitted no argument as to whether cedar trees are necessary for cedar rust on apple. There is none. If there were no cedar trees there would be no apple rust.

The importance of cedar rust as a disease needed no argument before this Society. There may have been some question as to the benefits of cedar eradication and the cost. Cut down the cedars and you will realize the benefits. Measure the cost, and you will find it the cheapest form of protection you can obtain against any apple disease.

There are thousands of cedars waiting for the axe.



